



**Barcelona
Supercomputing
Center**

Centro Nacional de Supercomputación



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AI, climate data and service development at the Barcelona Supercomputing Center

Francisco J. Doblas-Reyes



ICREA

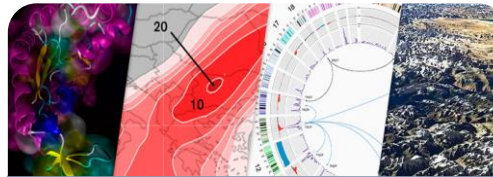
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BSC-CNS objectives



Supercomputing services
to Spanish and
EU researchers



R&D in Computer,
Life, Earth and
Engineering Sciences



PhD programme,
technology transfer,
public engagement

**BSC-CNS is
a consortium
that includes**

Spanish Government

60%



Catalonian Government

30%



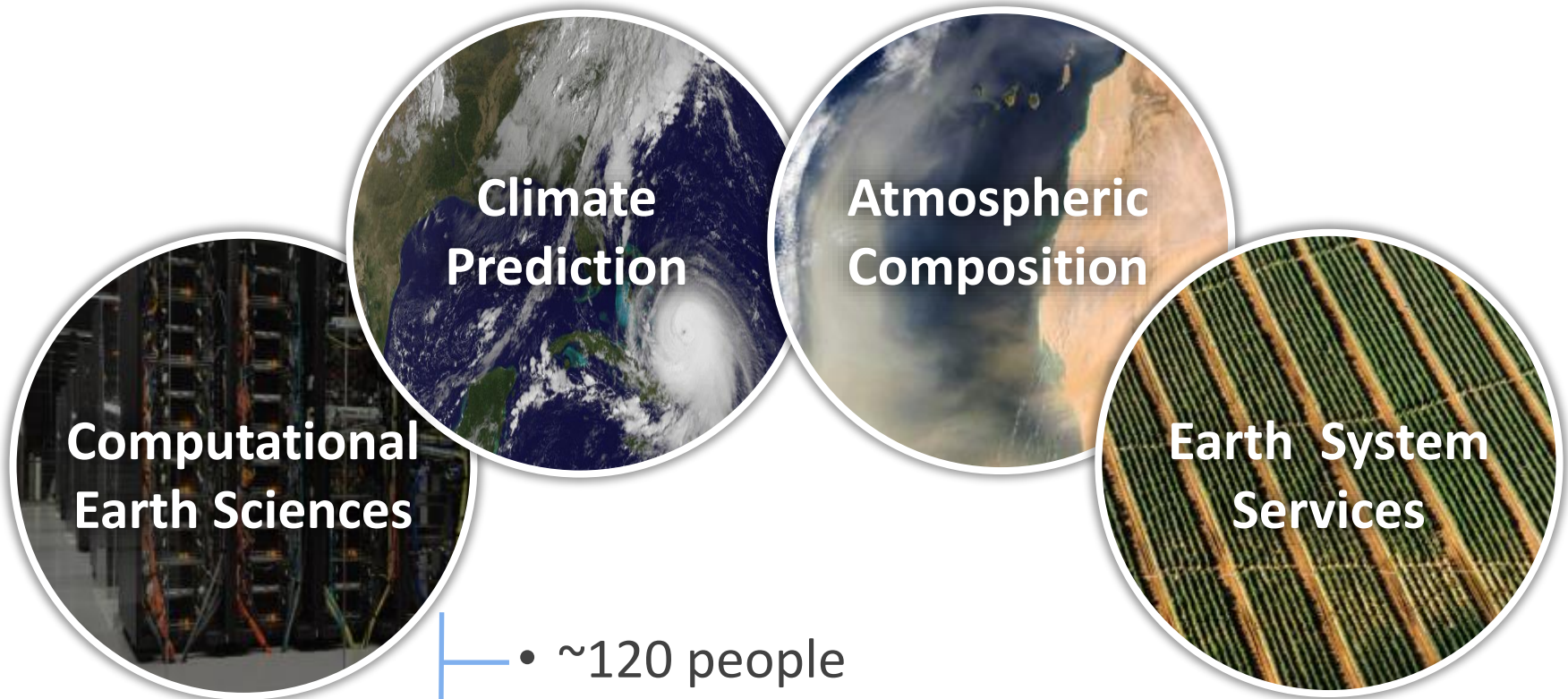
Univ. Politècnica de Catalunya (UPC)

10%



BSC's Earth Sciences Department

Environmental modelling and forecasting using process-based and artificial intelligence models, with a particular focus on **weather, climate and air quality**. This includes **transferring solutions** to support the main societal environmental challenges through data applications



- ~120 people
- Funding from EC, Copernicus, private sector, ESA, Spanish and regional governments

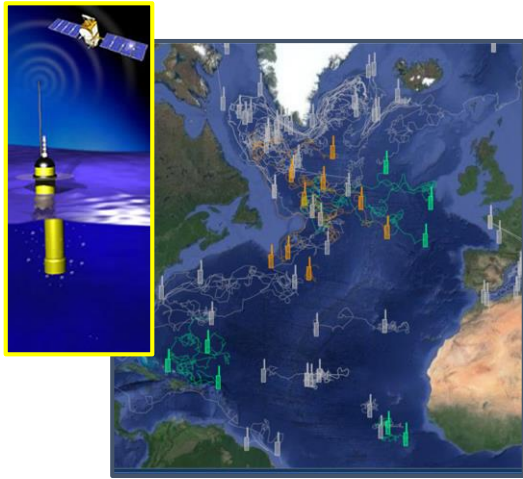
Global climate modelling

- Developers of a **global high-resolution Earth system model** with a high-resolution configuration (10 kms).
- The objective is to understand and **predict global climate** in time scales of one month to 100 years
- ...and how **carbon fluxes** will evolve (to inform future actions regarding the Paris Agreement)
- Explore the effectiveness of natural-based climate mitigation strategies, such as reforestation.



ORCAS: ORganic CARbon Sequestration in the ocean

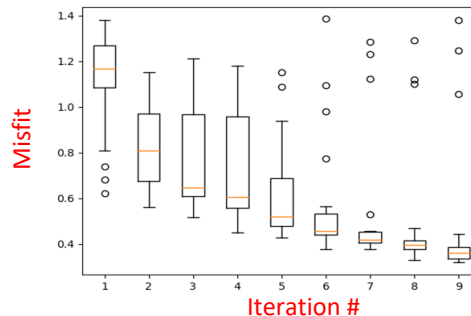
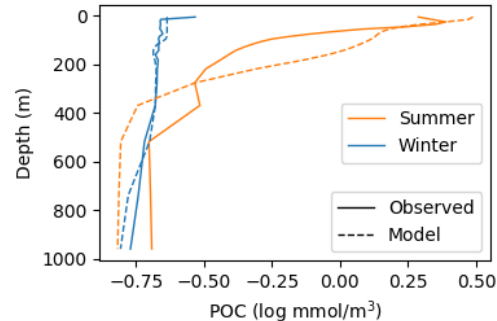
Constraining model predictions with novel high-resolution observations using AI (genetic algorithm).



Robotic measurements of ocean particles (with biogeochemical-Argo floats, 0-1000 m)

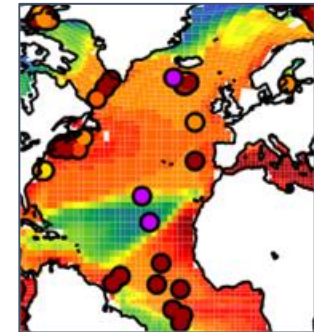
1D model

POC Comparison



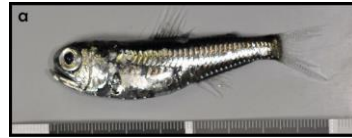
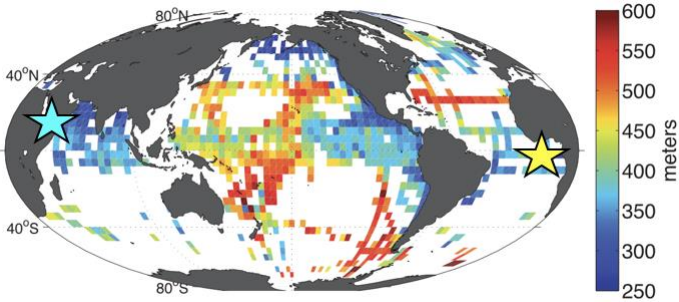
Reducing model-data misfit through parameter optimization (genetic algorithm)

3D model



Improving estimates of organic carbon storage with the PISCES (EC-Earth ocean biogeochemistry model)

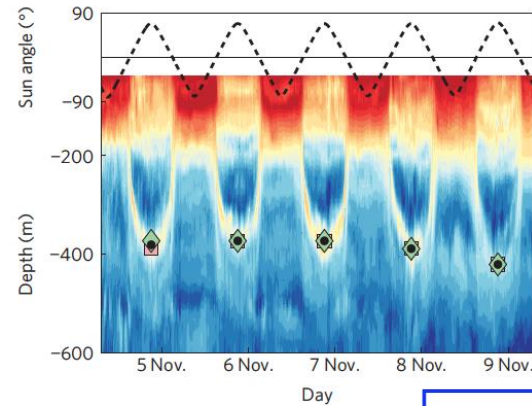
Characterising the twilight zone ecosystems



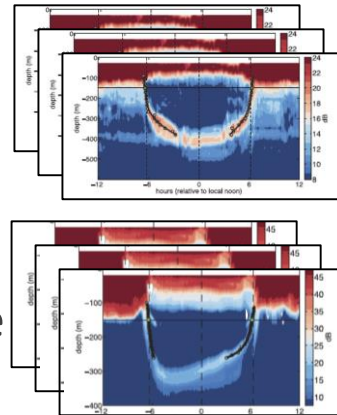
The twilight zone is:

- potential source of nutrients
- potential commercial exploitation
- but is it sustainable?
- strategic resource

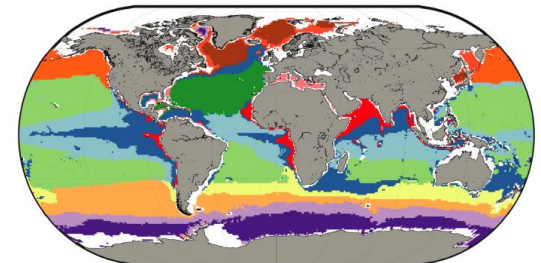
Bianchi et al, 2013



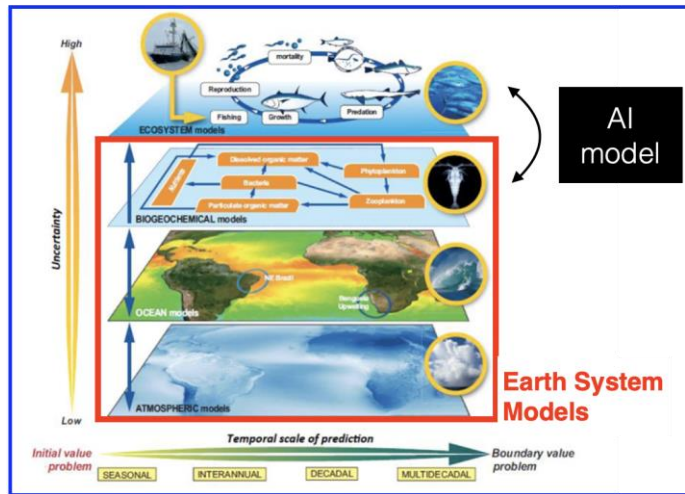
AI-based image classification



Environmental characterisation







Reygondeau et al, 2018

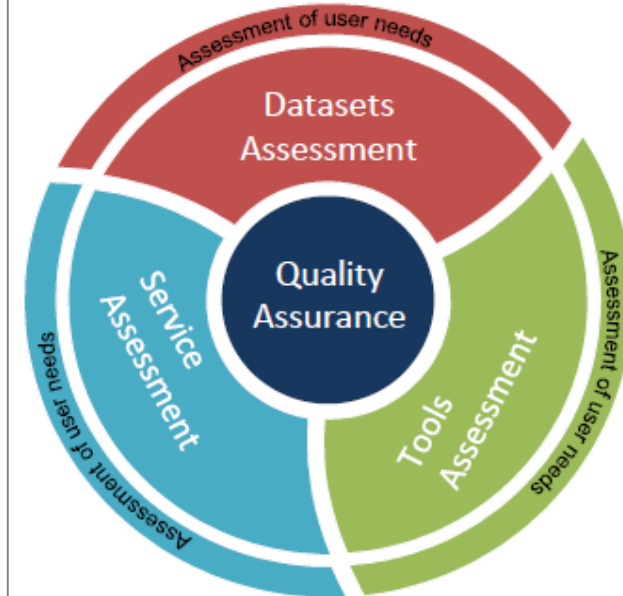


Evaluation and quality control

BSC leads the contract responsible of the development of the evaluation and quality control (EQC) function of the climate data store (CDS) of the Copernicus Climate Change Service (C3S) to:

- Provide a user-led overarching EQC service for the whole CDS
- Provide an independent quality assessment

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- CDS **datasets**: provide information about the technical and scientific quality and fitness-for-purpose, and an assessment of the datasets
 - CDS **toolbox**: assessment of maturity and fitness for purpose of the software provided to explore the datasets
 - CDS **service**: performance assessment of the CDS infrastructure (e.g. speed, responsiveness, system availability)
 - CDS **users**: user requirement assessment to measure users' satisfaction with the CDS. Map evolving user needs into viable user requirements to ensure a user-oriented evolution of the CDS



Evaluation and quality control

ERA5 monthly averaged data on single levels from 1979 to present

Overview

Download data

Quality assessment

Documentation

This is a new feature, work in progress. Should any inconsistency be found, please report to copernicus-support@ecmwf.int

The CDS datasets are independently assessed by the Evaluation and Quality Control (EQC) function of C3S. EQC encompasses a framework of processes aimed to assure technical and scientific quality harmonized across all dataset types available through the CDS. During the EQC process, the documentation provided with the dataset is scrutinized and data are checked for usability and reliability.

Variable:

2m temperature

▼ Variable: 2m temperature

Latest updated on 24/06/2020

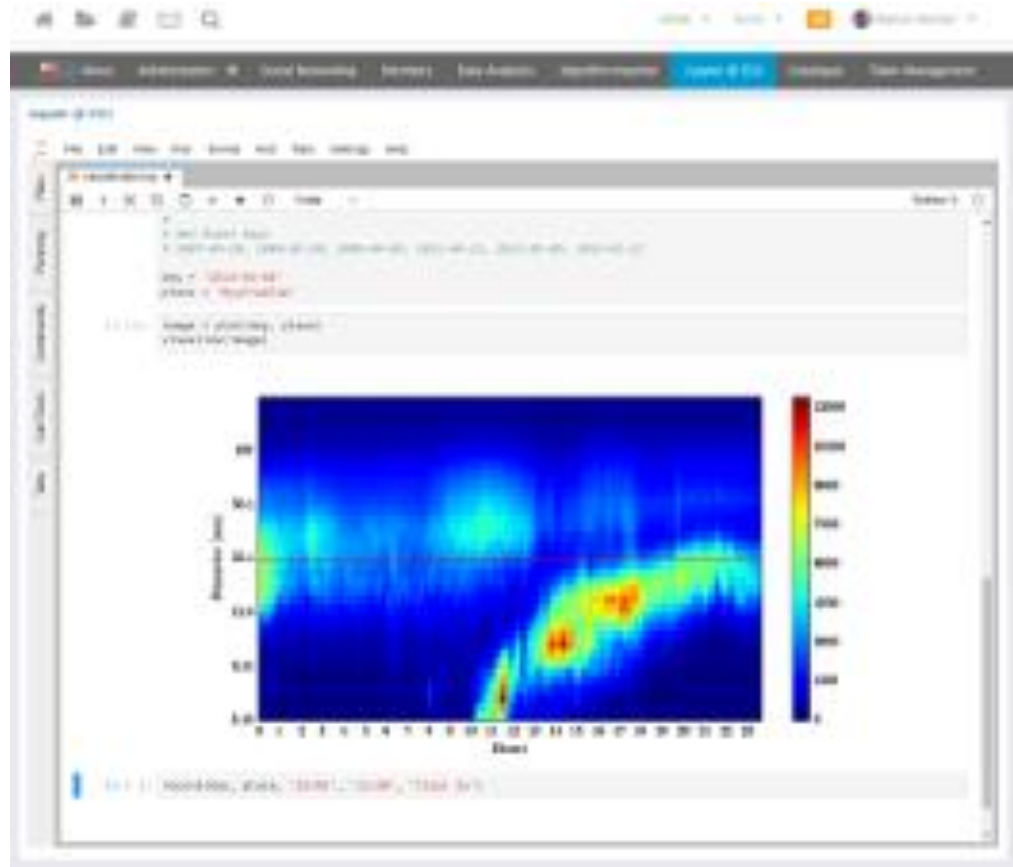
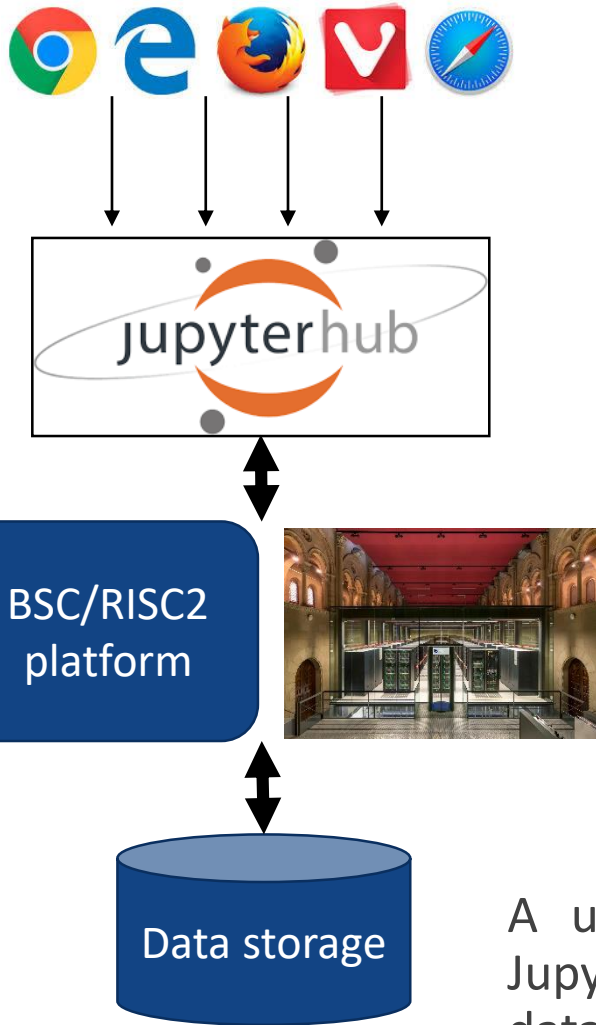
INTRODUCTION	USER DOCUMENTATION	ACCESS	INDEPENDENT ASSESSMENT
Dataset overview	User guide	Toolbox compatibility	Data check
Temporal and spatial coverage and resolution	Scientific methodology	Archive	Expert evaluation
Providers	Uncertainty quantification		Dataset maturity
Dataset version	Validation		Key strengths and limitations
Data update	Inter-comparison		

Entries with the mark | display content that is specific for the variable selected



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A broader sense of the service: Climate analysis cluster



A user-friendly data analysis cluster accessed through Jupyter Notebooks as the best way to enhance the user data analysis experience based on access to open and free Earth European data to ensure the sustainability, traceability and usefulness of the action.



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